

## Densities of Wading Birds on the Floodplain

Expectation:	Significant increase in use of floodplain wetlands by wading bird species (excluding Cattle Egrets). Wading bird use of the floodplain will increase a minimum 256% over baseline estimates, resulting in average annual densities of $\geq 18.9$ birds/km <sup>2</sup> .
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Relevant Endpoints:	Sociopolitical - Number of Birds Sociopolitical - Aesthetic Values Restoration - System Functional Integrity - Habitat Quality Restoration - System Functional Integrity - Habitat Use
Baseline Condition:	Aerial surveys were conducted monthly from May 1996-December 1998 in Pools A through D. Estimated mean annual wading bird densities per pool, excluding Cattle Egrets, ranged from $1.7 \pm 0.5$ to $6.7 \pm 1.4$ birds per km <sup>2</sup> (Table 1). Mean annual density of wading birds (excluding Cattle Egrets) in Pools A-D observed by Perrin et al. (1982) was similar, while data collected by Toland (1990) in 1987/88 resulted in somewhat higher mean annual density ( $9.8 \pm 4.3$ ). Data from all three of these baseline studies combined yield a mean annual density of $5.2 \pm 1.2$ wading birds per km <sup>2</sup> (Table 1).
Reference Conditions:	<p>No quantitative historic information is available on wading bird use of the Kissimmee River floodplain. Therefore, reference conditions have been derived from post-channelization studies (Perrin et al. 1982, Toland 1990) from Paradise Run and the Pool B flow-through marsh. Paradise Run is located at the downstream end of the Kissimmee River where it flows into Lake Okeechobee. Because of its connection to Lake Okeechobee, Paradise Run functions like littoral habitat and experiences some water level fluctuations associated with changes in the lake level. At higher lake stages this section of river floodplain may be inundated, providing different hydrologic characteristics than other portions of the channelized river (Perrin et al. 1982). The Pool B flow through marsh was constructed between 1984 and 1985. This portion of the floodplain is subjected to natural fluctuations in water levels due to rainfall. Survey data from these two sites were used as reference conditions for wading bird use of restored floodplain wetlands.</p> <p>Aerial surveys conducted in 1978-80 (Perrin et al. 1982) and 1987-88 (Toland 1990) reported average yearly densities of wading birds (excluding Cattle Egrets) ranging from <math>11.7 \pm 2.2</math> to <math>30.6 \pm 3.2</math> birds per km<sup>2</sup> for Paradise Run and the Pool B flow through marsh (Table 2). Data from both studies resulted in a mean annual wading bird density of <math>18.9 \pm 5.9</math> per km<sup>2</sup> (Table 2). Because of the extremely high variability in data reported by Perrin et al. (1982) and the lack of standard errors in Toland (1990), these data must be used with caution. However, because average wading bird densities at these reference sites were generally at least 200% greater than those observed in baseline samples from Pools A-D, we can infer that wading bird use of the Kissimmee River floodplain has decreased since channelization.</p>

Mechanism for

Achieving Expectation: Restoration of flooding regimes and hydroperiod will reestablish floodplain wetlands (Toth 1991, Toth et al. 1995). Increased river-floodplain interaction will facilitate increased prey abundance in floodplain wetlands (Toth 1991, Harris et al. 1995, Trexler 1995). Natural hydroperiods will concentrate prey in drying wetlands and thus improve foraging habitat for wading birds on the floodplain (Kushlan 1976, 1986).

Wading birds choose habitat at the landscape scale and are capable of locating newly available habitat quickly (Weller 1995, Frederick et al. 1996, Melvin and Gawlik 1999). With improved wetland conditions and greater prey abundance, wading birds are expected to move into newly created habitat through immigration from other areas. Some wetland habitat is currently available to wading birds in the channelized system for part of the year, however, habitat quality and the length of time it is available will increase due to restoration.

Adjustments for

External Constraints: Habitat conditions outside the Kissimmee floodplain may influence the magnitude of response by wading birds. If conditions are extremely poor elsewhere, the response may be much greater than expected. If conditions are very good all over the state, a lesser response may occur as birds will have more habitat to utilize.

Means of Evaluation:

The Before-After/Control-Impact (BACI) design will be employed (Stewart-Oaten et al. 1986) to test for relative changes at Control (Pool A) and Impact sites (Pools B, C, and D) before and after impact. In Kissimmee River restoration, the impact is restoration. Pre- and post-restoration aerial surveys are designed so that each Pool may be examined separately, thus facilitating relative comparisons between restored and unrestored portions of the floodplain. Collecting data separately for each Pool also allows for evaluation of wading bird response at the completion of each construction phase.

Standardized aerial surveys covering at least 15% of the floodplain will be conducted monthly. These data will be collected along randomly selected transects drawn from the same set of transects that was used during baseline sampling. If the data are normally distributed, analysis of variance (ANOVA) will be used to compare mean densities. Means that are not normally distributed will be tested using comparable non-parametric statistical tests. Differences will be considered significant if statistical analysis results in  $P < 0.05$ .

Annual wading bird density in the floodplain is expected to increase 256% based on the difference between average yearly densities from Pools B, C, and D baseline surveys ( $5.2 \pm 1.2$  birds/km<sup>2</sup>) and reference site data ( $18.9 \pm 5.9$  birds/km<sup>2</sup>).

Time Course:

Because wading birds are very mobile and choose habitat at the landscape scale (Frederick et al. 1996, Melvin and Gawlik 1999), a response to newly available habitat should occur immediately. However, the persistence of this response will depend upon prey availability at foraging sites. Wading birds are attracted to sites based on the availability of food as well as the presence of other birds (Krebs 1973). Several wet/dry cycles will be required for adequate prey populations to reestablish, and for individual prey to reach optimal sizes. Fish and aquatic invertebrate response to restoration will depend on the re-

establishment of appropriate hydrologic regimes, which will encourage growth of wetland vegetation. Results from a pilot study in the Kissimmee system suggest that colonization by wetland plant and invertebrate species can be rapid (Toth 1991). Fish and herptile population response is based on lower trophic level organisms such as aquatic invertebrates so some lag time will occur before there is an increase in these larger prey items. Fish are expected to respond within 3-12 years (Glenn 1998). A persistent increase in wading bird populations depends on the rapidity of response by these groups, so achievement of the expectation will occur in the same time frame as the fish community.

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Table 1. Mean ( $\pm$  SE) wading bird density (number/km<sup>2</sup>) in Pools A through D from aerial surveys conducted post channelization (1978-80; Perrin et al. 1982, 1987-88; Toland 1990) and baseline sampling (1996-98; Melvin unpubl).

Year	Control (Pool A)	B	C	D	Pools B,C,&D Combined	MEAN all years
1978/79	4.5 $\pm$ 1.3	2.3 $\pm$ 0.8	11.5 $\pm$ 4.0	1.6 $\pm$ 0.3	5.1 $\pm$ 3.2	5.2 $\pm$ 1.2
1979/80	3.4 $\pm$ 0.5	5.8 $\pm$ 1.3	3.8 $\pm$ 1.2	2.1 $\pm$ 0.5	3.9 $\pm$ 1.1	
1987/88*	14.9	17.5	9.4	2.5	9.8 $\pm$ 4.3	
1996/97	5.2 $\pm$ 1.2	3.2 $\pm$ 0.6	1.7 $\pm$ 0.5	2.6 $\pm$ 0.5	2.5 $\pm$ 0.4	
1997/98	6.2 $\pm$ 4.5	3.8 $\pm$ 0.6	2.8 $\pm$ 0.8	6.7 $\pm$ 1.4	4.4 $\pm$ 1.2	

\* no standard errors were reported for this data in Toland (1990).

Table 2. Mean ( $\pm$  SE) wading bird density (number/km<sup>2</sup>) for the Pool B flow through marsh and Paradise Run derived from Perrin et al. (1982) and Toland (1990).

Year	Paradise Run	Pool B Flow Through	Both Sites Combined	MEAN all years
1978-79	23.6 $\pm$ 46.8	5.1 $\pm$ 6.4	14.4 $\pm$ 9.3	18.9 $\pm$ 5.9
1979-80	9.5 $\pm$ 10.1	13.9 $\pm$ 19.2	11.7 $\pm$ 2.2	
1987-88*	33.8	27.4	30.6 $\pm$ 3.2	

\* no standard errors were reported for this data in Toland (1990).

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